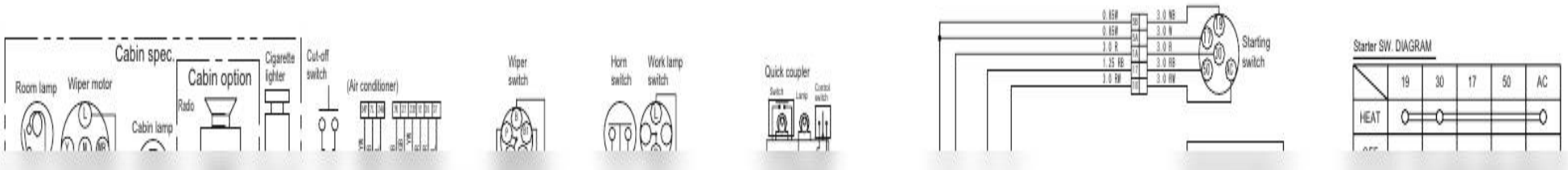
7. ADJUSTMENT AND REPAIR

7-1-3 Wiring Diagram

1) Standard Type



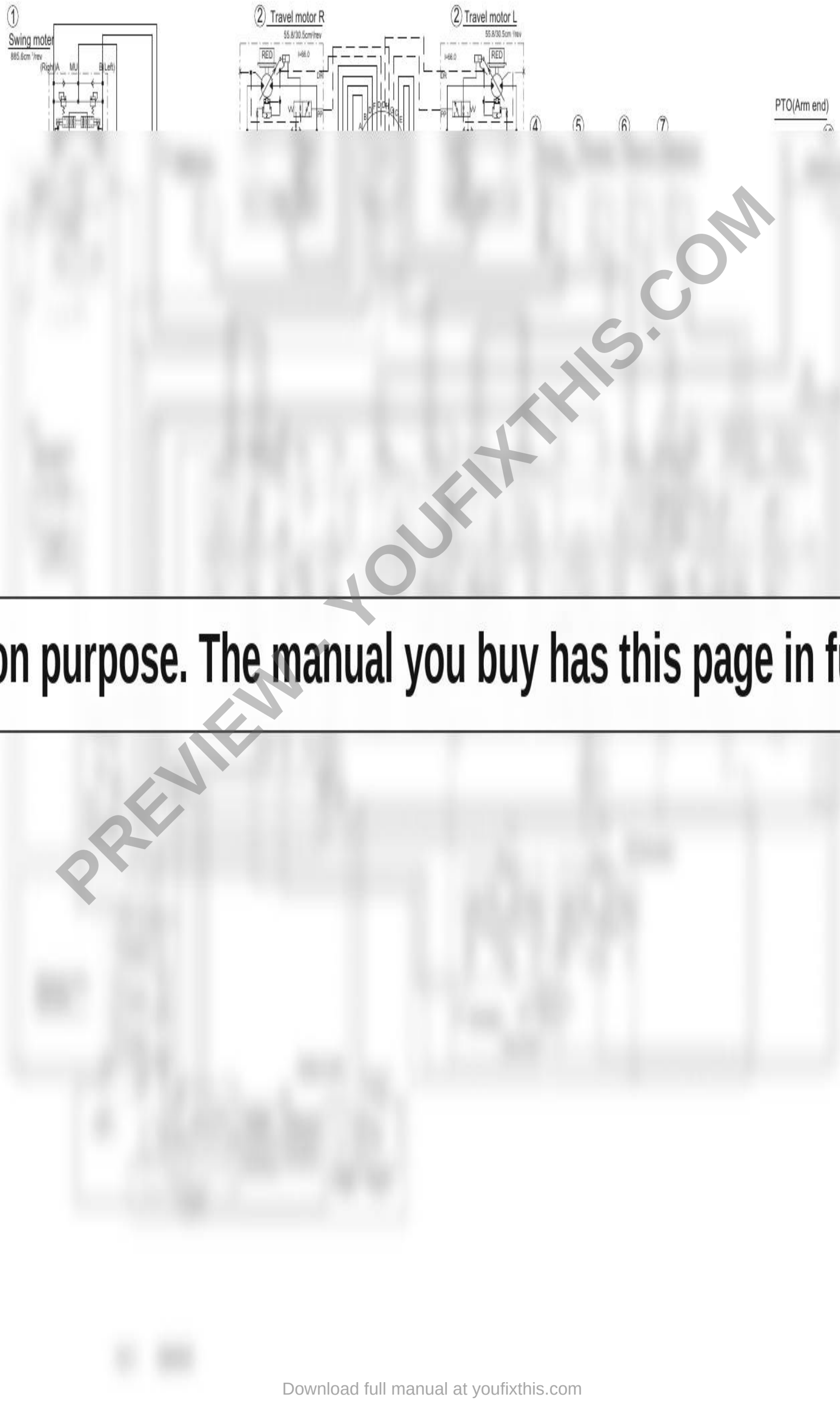
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5. HYDRAULIC SYSTEM

5-2 Hydraulic Circuit Schematic



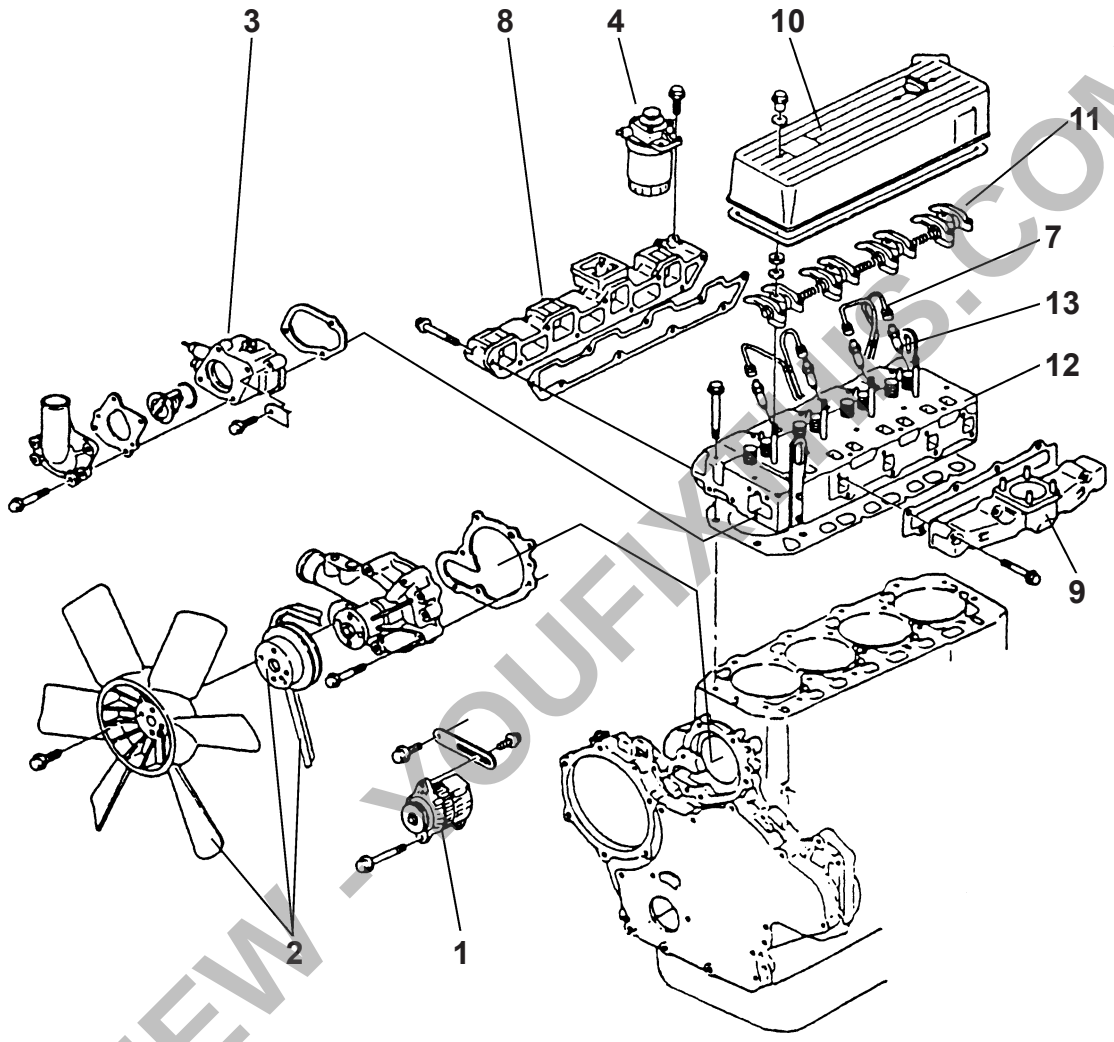
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4-4-2 Cylinder Head

1) Components



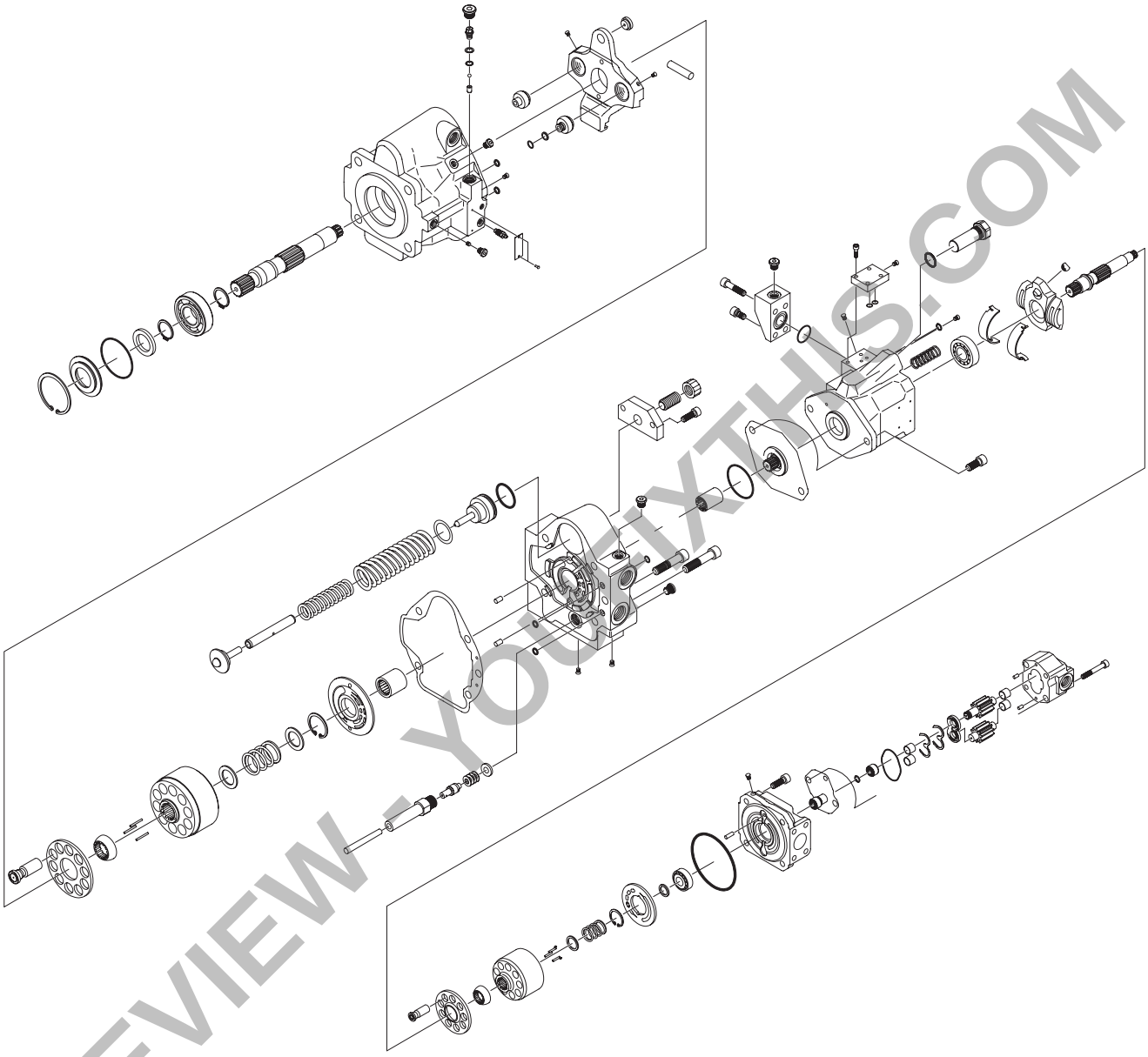
2) Disassembly Procedure :

Disassemble in the order of the numbers shown in the illustration.

1 Remove the alternator ass'y. ***(Point 1)***
2 Remove the fan, pulley and V belt.
3 Remove the thermostat case. ***(Point 2)***
4 Remove the fuel filter and fuel oil piping. ***(Point 3)***
5 Remove the oil level gage ass'y.
6 Remove the oil filter. ***(Point 4)***
7 Remove the fuel injection pipes. ***(Point 5)***
8 Remove the intake manifold ass'y.
9 Remove the exhaust manifold ass'y.
10 Remove the bonnet ass'y.
11 Remove the rocker shaft ass'y, push rods and valve caps. ***(Point 6)***
12 Remove the cylinder head ass'y and head gasket. ***(Point 7)***
13 Remove the fuel injection valves and fuel return pipe. ***(Point 8)***
14 Remove the intake/exhaust valves, stem seals and valve springs. ***(Point 9)***
15 Remove the rocker arms from the rocker shaft.

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3. Exploded View and Parts Comprised

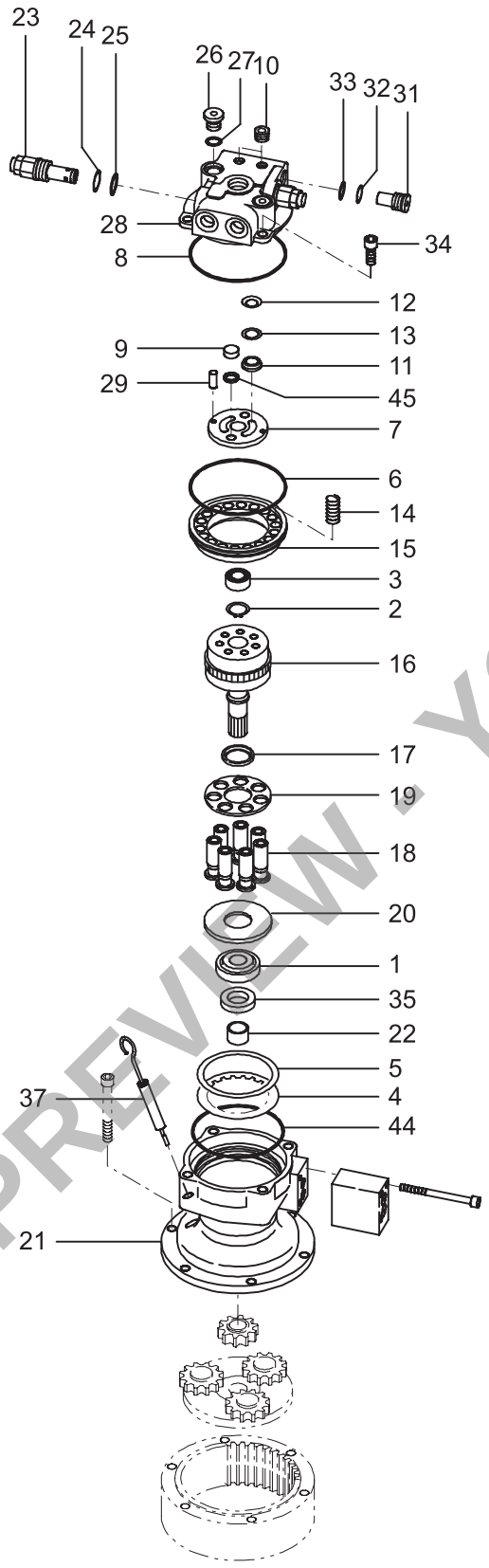


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2) Motor

(1) Exploded view and parts



No.	Part	Q'ty
1	Taper roller bearing	1
2	Snap ring	1
3	Needle bearing	1
4	Friction plate	1
5	Steel plate	1
6	O-ring	1
7	Balance plate	1
8	O-ring	1
9	Piston	2
10	Plug R (PT) 1/4	2
11	Bush	4
12	Wave washer	4
13	Teflon ring	4
14	Spring	18
15	Brake piston	1
16	Cylinder	1
17	Spring ring	1
18	Piston S/A	7
19	Return plate	1
20	Cam plate	1
21	Housing	1
22	Collar	1
23	Relief valve	2
24	Back-up ring	2
25	O-ring	2
26	Cap	1
27	O-ring	1
28	Cover	1
29	Dowel pin	2
31	Bypass valve	2
32	Back-up ring	2
33	O-ring	2
34	Hexagon socket head bolt	4
35	Oil seal	1
37	Level gauge CMP	1
44	O-ring	1
45	Teflon ring	1

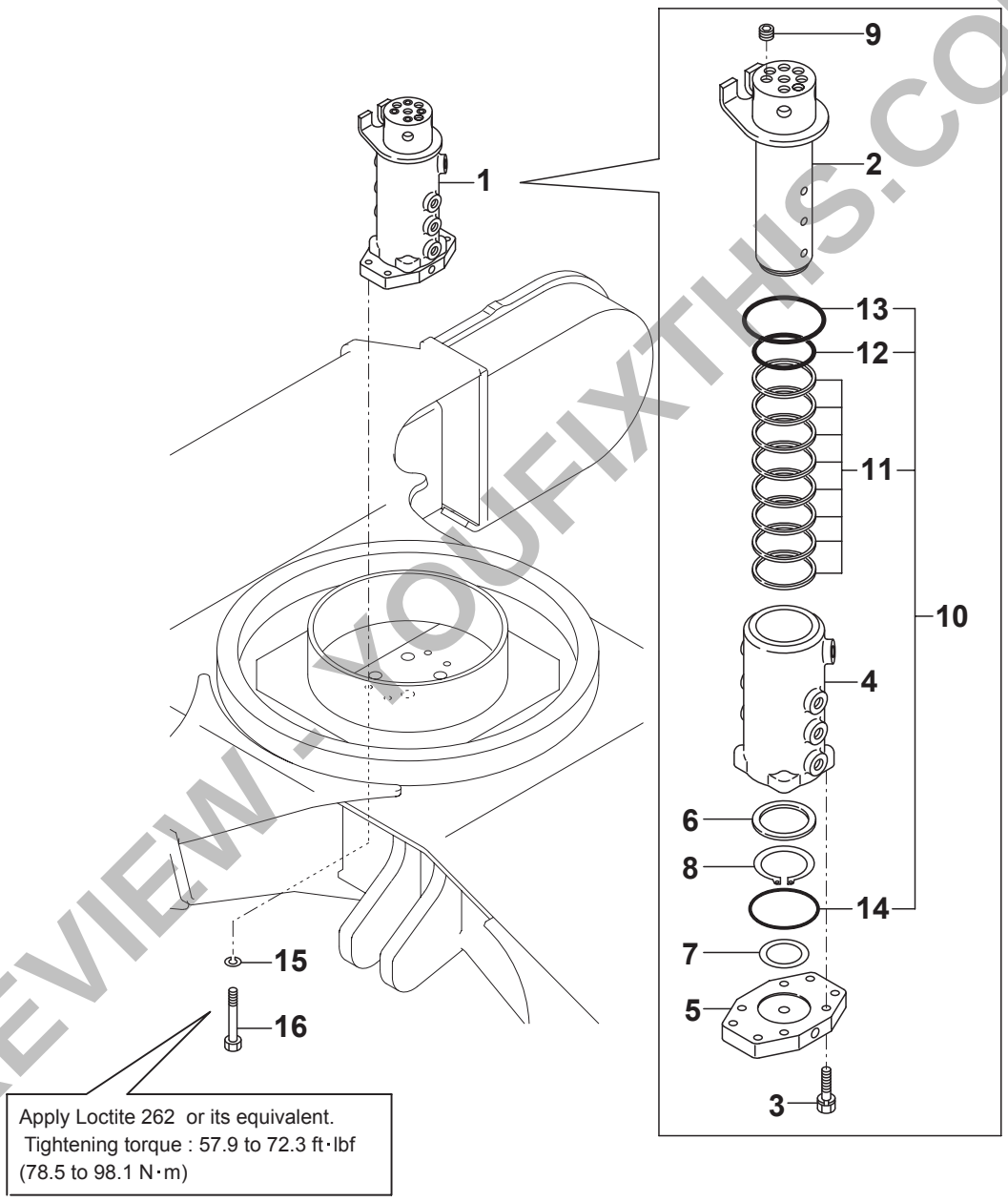
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7-5-5 Disassembly and Reassembly of Swivel Joint

1) Swivel Joint

The swivel joint is used to prevent the hydraulic piping from twisting when the upperstructure swings. The swivel joint consists of the shaft, hub and seal kit. The shaft and hub have holes and grooves, and the oil supplied from the port of the shaft, passing through the hub groove, is fed to the actuators of the undercarriage.

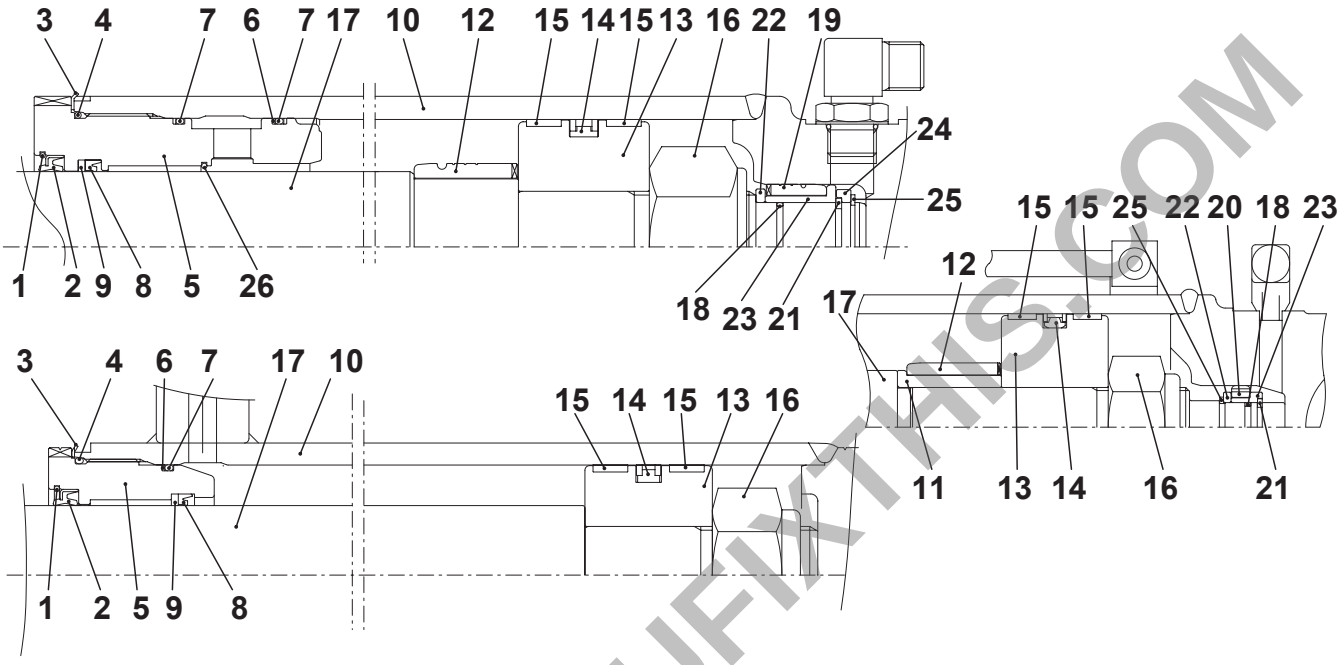


No.	Part	Q'ty	No.	Part	Q'ty
1	Swivel joint assembly	1	9	Screw plug R (PT) 3/8	4
2	Swivel shaft	1	10	Seal kit (for swivel)	1
3	Bolt (with spring washer 10×40)	4	11	Swivel seal	8
4	Swivel hub	1	12	O-ring 1A P 80.0	1
5	Swivel plate	1	13	O-ring 1A P 100.0	1
6	Swivel spacer	1	14	O-ring 1A P 95.0	1
7	Thrust washer	1	15	Spring washer 12	4
8	External snap ring 70	1	16	Bolt 12×40	4

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7-5-6 Disassembly and Reassembly of Hydraulic Cylinders

1) Sectional View and Parts



No.	Part	Boom	Arm	Bucket		Boom swing	Blade	Quick coupler
				W/O QC	QC			
1	Spring ring	○	○	○		○	○	—
2	Dust seal	○	○	○		○	○	○
3	Lock washer	○	○	○		○	○	○
4	O-ring	○	○	○		○	○	○
5	Head	○	○	○		○	○	○
6	Back-up ring	○	○	○		○	○	—
7	O-ring	○	○	○		○	○	○
8	ISI packing	○	○	○		○	○	○
9	Back-up ring	○	○	○		○	○	—
10	Cylinder tube (Inside diameter)	Ø4.7 (Ø120)	Ø4.3 (Ø110)	Ø3.7 (Ø95)		Ø4.7 (Ø120)	Ø5.1 (Ø130)	Ø3.15 (Ø80)
11	Cushion collar	○	—	—		○	—	—
12	Cushion plunger	○	○	—		○	—	—
13	Piston	○	○	○		○	○	○
14	Piston seal	○	○	○		○	○	○
15	Wearing ring	○	○	○		○	○	○
16	U-nut	M55×3.0	M48×3.0	M42×3.0		M42×3.0	M48×3.0	M27×2.0
17	Rod (Outside diameter)	Ø2.8 (Ø70)	Ø2.6 (Ø65)	Ø2.4 (Ø60)		Ø2.4 (Ø60)	Ø2.6 (Ø65)	Ø1.8 (Ø45)
18	O-ring	○	○	—		○	—	—
19	Cushion plunger	○	○	—		—	—	—
20	Cushion ring	○	—	—		○	—	—
21	Stopper	○	○	—		○	—	—
22	Spacer	○	○	—		○	—	—
23	Cushion collar	○	○	—		○	—	—
24	Cover (stopper)	○	○	—		—	—	—
25	External snap ring C	○	○	—		○	—	—
26	Spring ring	○	○	—		—	—	—

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3-7 List of Tightening Torque

3-7-1 Machine

Applicable model			SV100		
Equipment			Thread size	Tightening torque ft•lbf (N•m)	Adhesive
	No.	Tightening part			
Engine / Electrical equipment					

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4-2 Troubleshooting

4-2-1 Quick Reference Table for Troubleshooting

The following table summarizes the general trouble symptoms and their causes. If ant trouble symptom occurs, take corrective action before it develops into a serious problem so as not to shorten the engine service life.

	Trouble symptom / Cause	Starting failure: Engine does not start	Starting failure: Engine starts but stops soon: Exhaust smoke: None	Starting failure: Engine starts but stops soon: Exhaust smoke: Little	Starting failure: Engine starts but stops soon: Exhaust smoke: Much	Insufficient engine output: Exhaust color: Ordinary	Insufficient engine output: Exhaust color: White	Insufficient engine output: Exhaust color: Black	Poor exhaust color: During work: White	Poor exhaust color: During work: Black	High knocking sound during combustion	Abnormal engine sound	Uneven combustion sound	Hunting: During idling	Hunting: During work	Large engine vibration	Difficulty in returning to low speed	Excessive fuel consumption	Lubricating oil: Excessive consumption	Lubricating oil: Dilution by fuel oil	Lubricating oil: Mixture with water	Lubricating oil: Low L.O. pressure	Much blow-by gas	Cooling water: Overheat	Cooling water: Low water temperature	Air intake: Pressure drop	Air intake: Pressure rise	Exhaust temperature rise		Corrective action
Engine system	Improper clearance of intake/exhaust valve	○	○			○						○														○		○		Adjust the valve clearance.
	Compression leakage from valve seat					○		○		○		○						○					○			○		○		Lap the valve seat.
	Seizure of intake/exhaust valve	○			○	○		○		○		○		○	○					○			○			○				Correct or replace.
	Blowout from cylinder head gasket					○															○			○						Replace the gasket.
	Seized or broken piston ring	○			○		○		○			○		○		○			○	○			○	○				○		Replace the piston ring.
	Worn piston ring, piston or cylinder	○			○		○		○										○	○			○							Perform honing and use oversize parts.
	Seized crankpin metal or bearing	○	○									○		○	○	○							○							Repair the replace.
	Improper arrangement of piston ring joints		○				○												○				○							Correct the ring joint positions.
	Reverse assembly of piston rings						○		○										○				○							Reassemble correctly.
	Worn crankpin and journal bearing					○						○		○	○	○						○								Measure and replace.
	Loosened connecting rod bolt											○				○						○								Tighten to the specified torque.
	Foreign matter trapped in combustion chamber	○										○							○				○							Disassemble and repair.
	Excessive gear backlash											○																		Adjust gear meshing.
	Worn intake/exhaust valve guide						○												○				○							Measure and replace.
	Defective governor		○											○	○	○	○													Make adjustment.
	Improper open/close timing of intake/exhaust valves	○					○	○	○	○		○																		Adjust the valve clearance.
Turbocharger	Fouled blower							○		○																				Clean the blower
	Waste gate malfunction							○		○																				Disassemble, inspect and correct
	Worn floating bearing						○		○																					Disassemble, inspect and correct

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2. TECHNICAL DATA

2. Technical Data

2-1 Specifications

Item	Unit	SV100
Main specifications of machine		
Dimensions		

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1. GENERAL CAUTIONS FOR MAINTENANCE WORK

1. General Cautions for Maintenance Work

1-1 Correct Work

Correct work means the quickest possible completion of according to the correct procedures and the specified standards.

It is important when conducting certain operations always to bear in mind the equipment, tools, gauges, materials, oil and grease, etc. that you must have ready, as well as items to be checked, adjusted, or disassembled, and cautions to watch out for.

1-2 Safety Precautions

(1) Never attempt servicing while engine is running or immediately after stopping operation.
(2) Wear work cloths, safety shoes and helmet.
(3) Check the equipment and tools before use. Especially, be sure to check the crane, lifting equipment and tools.
(4) When working together with other persons, allocate everyone's share of job, arrange the signals and act in concert with the other persons.
(5) The operation of the crane and slinging work must be performed by qualified persons.
(6) Do not enter or pass under the raised load.
(7) Lift and support the massive parts by crane before removing the installation bolts.
(8) Disconnect cables from battery before repairing the electric system.
(9) Remove the battery when welding the machine.

1-3 Preparations

(1) Check the service record of the machine. (That is, check how many months or hours the machine has been used since the preceding overhaul, what was the trouble then and what parts were replaced.)
(2) Have all servicing tools ready, i.e., tools, measuring devices (which have received periodic maintenance), containers, oil & grease, etc.
(3) Have the service literature (operation manual, parts catalog, etc.) ready.

1-4 Cautions for Disassembly and Reassembly

(1) Clean the machine before disassembly.
(2) Check and record the condition of the machine before disassembly :
  • Model, machine number, operation hours
  • Reasons for repair, history of repair
  • Contamination of filters
  • Fuel and oil condition
  • Damage to parts, etc.
(3) Place alignment marks on the necessary parts to facilitate reassembly.
(4) Clean all the removed parts and new replacement parts and put them in order.
(5) Use new seals, split pins, etc. for reassembly.

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4-3-12 Periodic Maintenance Schedule

The engine periodic inspection timing is hard to determine as it varies with the application, load status, qualities of the fuel and lubricating oils used and handling status. General rules are described here.

○ : Inspection ◇ : Parts replacement

Classification	Item	Daily	Maintenance period				
			Every 50 hours	Every 250 hours	Every 500 hours	Every 1000 hours	Every 2000 hours
Fuel oil system	Fuel tank level check and fuel supply	○					
	Fuel tank draining		○				
	Water separator draining (Option)		○ Every 100 hours				
	Water separator cleaning (Option)				○		
	Fuel filter element replacement				◇		
Lube oil system	Lube oil level check	○					
	Lube oil replacement		◇ 1st time	◇ 2nd time and there after			
	Lube oil filter replacement						
Cooling water system	Cooling water level check and replenish	○					
	Radiator fin cleaning			○			
	Cooling fan V-belt tension check	○					
	Cooling water replacement					◇	
	Cooling water path flushing and maintenance					○ within one years	
Fuel oil, lube oil and cooling water leakage check		○					
Rubber hose	Fuel pipe and cooling water pipe inspection and maintenance						○
Air intake system	Air cleaner cleaning and element replacement			○	◇		
	Turbocharger blower cleaning					○	
Electrical system	Warning lamp & instruments function check	○					
	Battery electrolyte level check and battery recharging	○					
Cylinder head	Intake/exhaust valve head clearance adjustment					○	
Fuel injection pump and valve	Fuel injection valve pressure inspection					○	
	Fuel injection timing inspection						○

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Applicable model				4TNV98T-SBV	
Item			Unit	Standard	Wear limit
Crank shaft					
	Journal	Outside dia.	in. (mm)	2.5572 to 2.5576 (64.952 to 64.962)	2.5552 (64.902)
		Main metal inside dia.		2.5591 to 2.5598 (65.000 to 65.020)	-
		Main metal thickness		0.0785 to 0.0791 (1.995 to 2.010)	-
		Oil clearance		0.0015 to 0.0027 (0.038 to 0.068)	0.0059 (0.150)
	Bend			-	0.0008 (0.02) or less
Idle gear		Shaft outside dia.	in. (mm)	1.8091 to 1.8100 (45.950 to 45.975)	1.8071 (45.900)
		Bush inside dia.		1.8110 to 1.8120 (46.000 to 46.025)	1.8140 (46.075)
		Oil clearance		0.0010 to 0.0030 (0.025 to 0.075)	0.0069 (0.175)
Trochoid pump		Outside clearance of outer rotor	in. (mm)	0.0039 to 0.0061 (0.100 to 0.155)	0.0098 (0.25)
		Side clearance of outer rotor		0.0020 to 0.0039 (0.05 to 0.10)	0.0059 (0.15)
		Inside clearance of inner rotor		0.0118 to 0.0197 (0.3 to 0.5)	0.0236 (0.6)
		Width across flat clearance of inner rotor		0.0079 to 0.0236 (0.2 to 0.6)	0.0276 (0.7)
Side gap		Crank shaft	in. (mm)	0.0051 to 0.0091 (0.13 to 0.23)	0.0110 (0.28)
		Cam shaft		0.0020 to 0.0079 (0.05 to 0.20)	0.0118 (0.30)
		Connecting rod		0.0079 to 0.0157 (0.20 to 0.40)	-
		Idle gear		-	-
Backlash		Crank gear, cam gear, idle gear and fuel injection pump drive gear	in. (mm)	0.0031 to 0.0055 (0.08 to 0.14)	0.0063 (0.16)
		Lubricating oil pump gear		0.0035 to 0.0059 (0.09 to 0.15)	0.0067 (0.17)
Others					
	Oil pressure regulating valve opening pressure		PSI (MPa)	56.9 to 71.1 (0.39 to 0.49)	8.7 (0.06) at low idle
	Oil pressure switch operating pressure		PSI (MPa)	56.9 to 85.6 (0.39 to 0.59)	-
	Thermostat valve opening temperature	Temperature	°F (°C)	157.1 to 162.5 (69.5 to 72.5)	-
		Lift at opening	in. (mm)	0.315 (8.0) or more at 185°F (85°C) or higher	-
	Thermo-switch operating temperature	ON	°F (°C)	224.6 to 235.4 (107 to 113)	-
		OFF		212 (100) or more	-

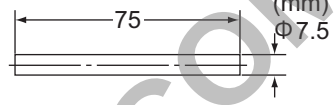
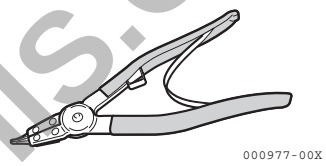
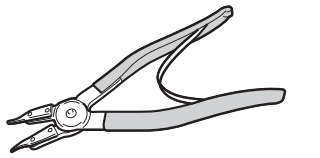
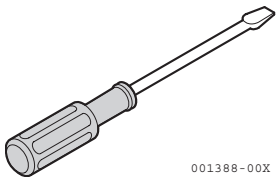
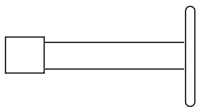
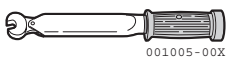
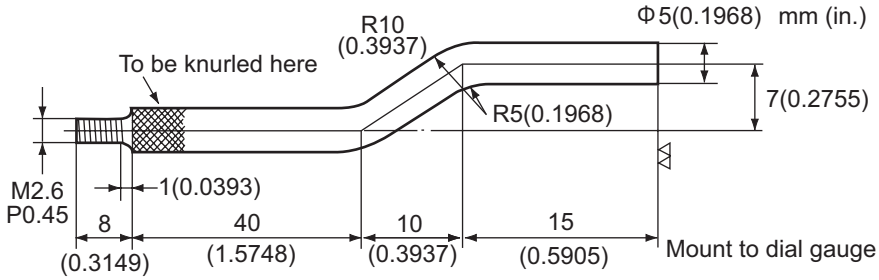
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4-8-4 Disassembly Procedure

1) Preparation for Disassembly

In addition to the general tools, the following special tools are required for turbocharger disassembly and reassembly:

Tool name	Use	Illustration
Bar	For removing thrust bearing and thrust bushing	 Material : Copper or brass
Pliers	For removing floating bearing circlip	
Pliers	For removing seal ring	
Torque driver for TORX bolt (multifunctional type) 0.5 to 4.9 N•m (5 to 50 kgf•cm)	For thrust bearing installation (for M3) : 1.0 ft•lbs (1.3 N•m) For seal plate installation (for M3) : 1.0 ft•lbs (1.3 N•m)	Item sold on market  (Type : TORX TT20 or equivalent)
Box wrench	For fixing turbine shaft (mm × dodecagonal)	 Box only may be used.
Torque wrench (single purpose)	For following bolts and nuts: M8 : mm, kgf•cm (N•m) M5 : mm, kgf•cm (N•m) M5 : mm, kgf•cm (N•m)	
Probe	For measuring play in axial and radial directions : To be installed on a dial gage	

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4-12-2 Engine Body

1) Cylinder Head

(1) Cylinder head

Inspection item				Standard	Limit	Reference page
Combustion surface distortion			in. (mm)	Max. 0.002 (0.05)	0.006 (0.15)	4-4-5
Valve seat	Valve sink	Intake	in. (mm)	0.02 to 0.028 (0.5 to 0.7)	0.039 (1.0)	4-4-5
		Exhaust	in. (mm)	0.024 to 0.031 (0.6 to 0.8)	0.043 (1.1)	4-4-5
	Seat width	Intake	in. (mm)	0.051 (1.3)	0.079 (2.0)	4-4-5
		Exhaust	in. (mm)	0.087 (2.2)	0.118 (3.0)	4-4-5
	Seat angle	Intake	degrees	120	–	4-4-8
		Exhaust	degrees	90	–	4-4-8
	Seat correction angle		degrees	θ_1 : 40 θ_2 : 50	–	4-4-8

(2) Intake/exhaust valve and guide

Inspection item			Standard	Limit	Reference page
Intake	Valve stem outside diameter	in. (mm)	0.3136 to 0.3142 (7.965 to 7.980)	0.3136 (7.915)	4-4-6
	Guide inside diameter	in. (mm)	0.3156 to 0.3161 (8.015 to 8.030)	0.3189 (8.100)	4-4-6
	Clearance	in. (mm)	0.0014 to 0.0026 (0.035 to 0.065)	0.0073 (0.185)	4-4-6
Exhaust	Valve stem outside diameter	in. (mm)	0.3132 to 0.3138 (7.955 to 7.970)	0.3112 (7.905)	4-4-6
	Guide inside diameter	in. (mm)	0.3156 to 0.3161 (8.015 to 8.030)	0.3189 (8.100)	4-4-6
	Clearance	in. (mm)	0.0018 to 0.0030 (0.045 to 0.075)	0.0077 (0.195)	4-4-6
Valve guide driving-in method		in. (mm)	Cold-fitted	–	4-4-9
Valve guide projection from cylinder head		in. (mm)	0.5787 to 0.5906 (14.7 to 15.0)	–	4-4-9
Replacement valve guide inside diameter after insert		in. (mm)	0.3156 to 0.3161 (8.015 to 8.030)	–	4-4-9

(3) Valve spring

Inspection item		Standard	Limit	Reference page
Free length	in. (mm)	1.87 (47.5)	–	4-4-7
Inclination	in. (mm)	–	0.047 (1.2)	4-4-7
Load for compressing uneven pitch portion by 0.039 in. (1 mm)	N (kgf)	22.1 (2.257)	–	–

(4) Rocker arm and shaft

Inspection item		Standard	Limit	Reference page
Arm shaft hole diameter	in. (mm)	0.7283 to 0.7291 (18.50 to 18.52)	0.7311 (18.57)	4-4-7
Shaft outside diameter	in. (mm)	0.7272 to 0.7280 (18.47 to 18.49)	0.7260 (18.44)	4-4-7
Clearance	in. (mm)	0.0004 to 0.0020 (0.01 to 0.05)	0.0051 (0.13)	4-4-7

(5) Push rod

Inspection item	Standard	Limit	Reference page
Bend	–	0.0012 (0.03)	4-4-7

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6. Disassembly and Reassembly

1) Precautions for Disassembly and Reassembly

(1) Since the parts of this hydraulic system are precision made for tight clearances, be sure to perform disassembly and reassembly in a clean area that is free from dust.
(2) Prepare clean tools and cleaning oil and handle them carefully.
(3) First clean the external surface of removed assemblies.
(4) Before beginning, review the drawings of the internal construction and prepare the required parts according to the purpose and extent of disassembly.
(5) Never disassemble or readjust adjust screws unless required.
(6) In principle, seals and rings that have been removed must be replaced with new ones. As some replacement parts are available only in sub-assemblies, refer to the parts catalogue to prepare the necessary subassemblies in advance.
(7) O-rings
  [1] Lubricate the O-ring and the O-ring fitting seat with clean grease or hydraulic oil.
  [2] O-rings may not be damaged or distorted by heat.
  [3] Do not permanently deform O-rings.
  [4] Avoid rolling the O-ring when fitting it.
    A distorted O-ring may not return to its original shape, and therefore may cause oil leaks.
(8) Before beginning reassembly, check the mating surfaces of each section to be sure that there is no cleaning oil or hydraulic oil present. If reassembly is performed without cleaning this oil, it may be mistaken for oil leakage.
(9) Follow torque specifications.

2) Tools for Disassembly and Reassembly

Tools	Size
Hexagon socket screw key	5 mm, 6 mm, 8 mm, 10 mm, 12 mm
Wrench	27, 32
Plastic hammer	Medium
Snap ring pliers	For internal snap ring 80 mm
Screw driver	Medium
Torque wrench	-
Grease	-
Adhesive	Three Bond 1305

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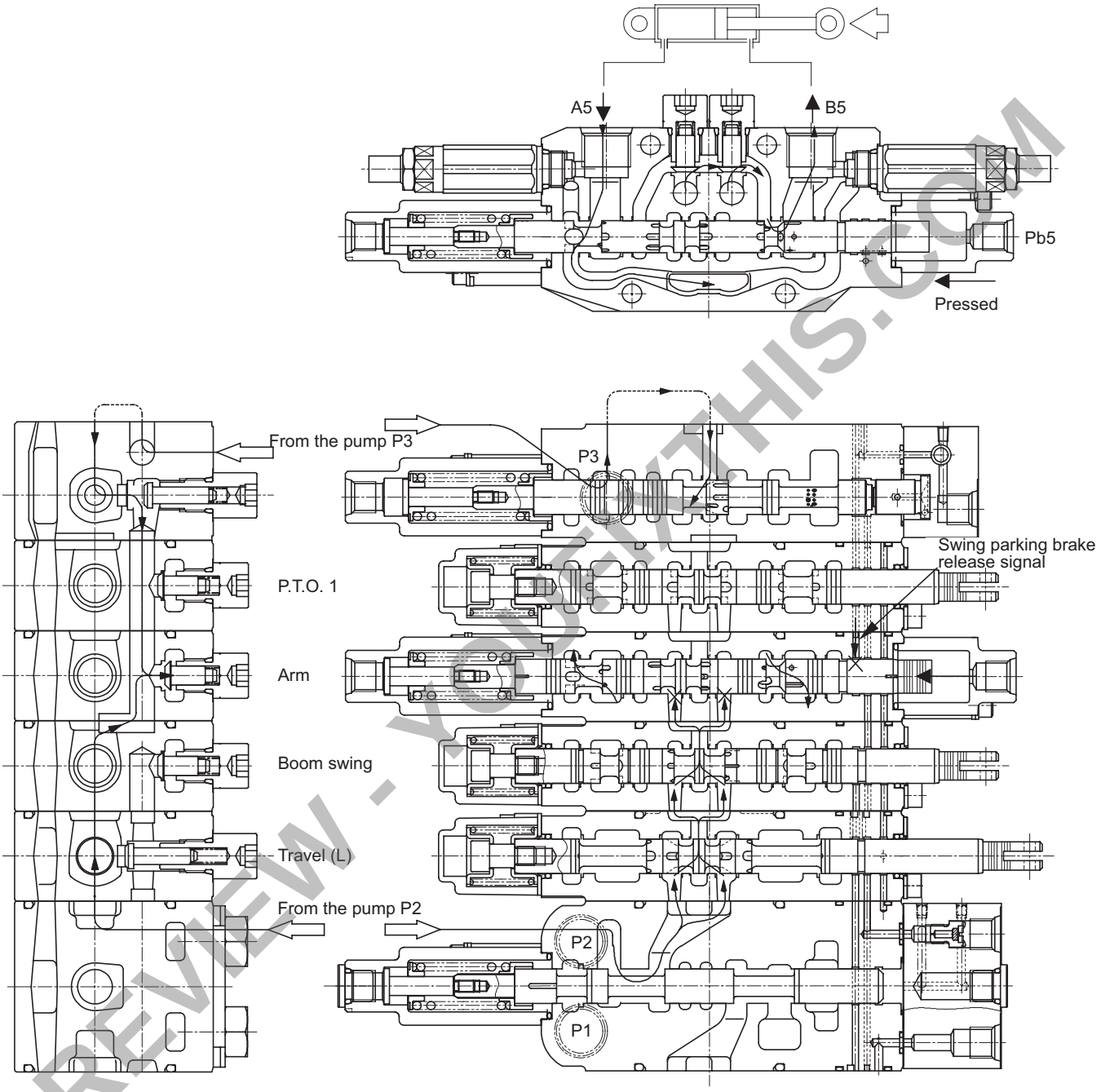


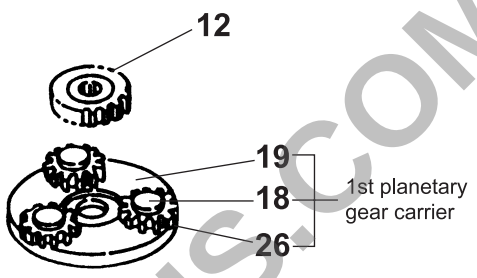
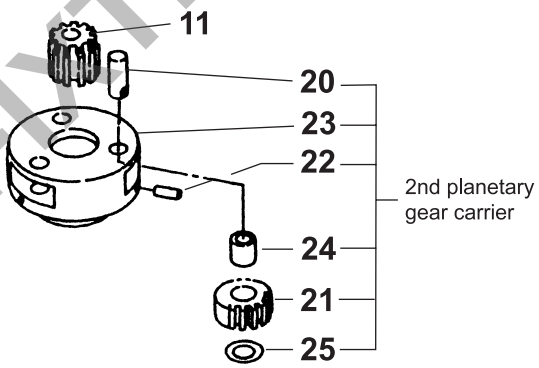
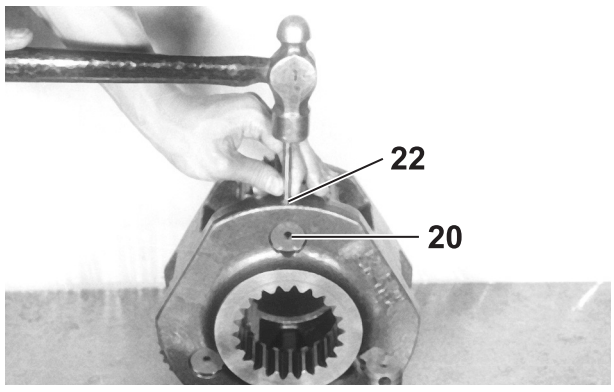
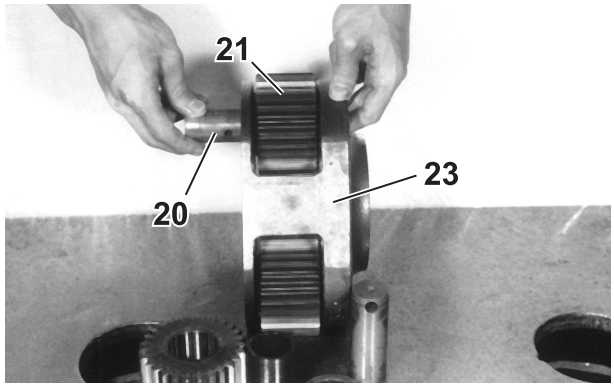
Fig. 17 Arm extend operation

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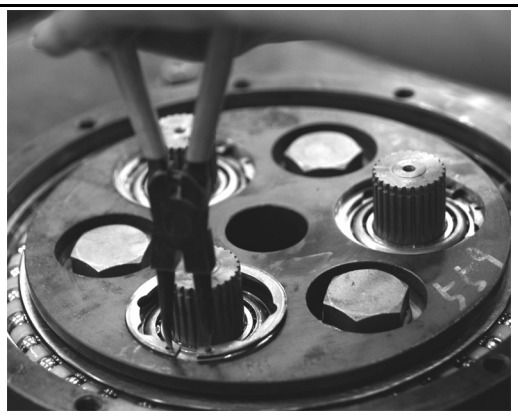
(2) Procedures

[1] Disassembly

Procedure	
(1) Remove sun gear **12** and 1st planetary gear carrier. ***Note :*** *The planetary carrier cannot be disassembled because each shaft 1 **18** is caulked to holder **19**.*	
(2) Remove spur gear 4 **11** and 2nd planetary gear carrier.	
(3) Drive spring pin **22** into shaft **20**. ***Note :*** *Spring pin should not be reused.*	
(4) Remove shaft **20** from 2nd planetary gear carrier while holding spur gear 5 **21** with one hand.	

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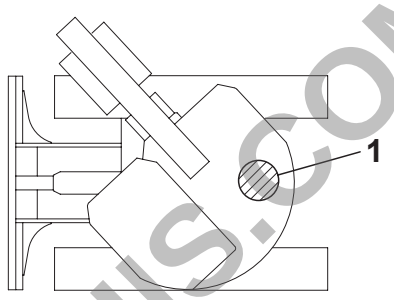
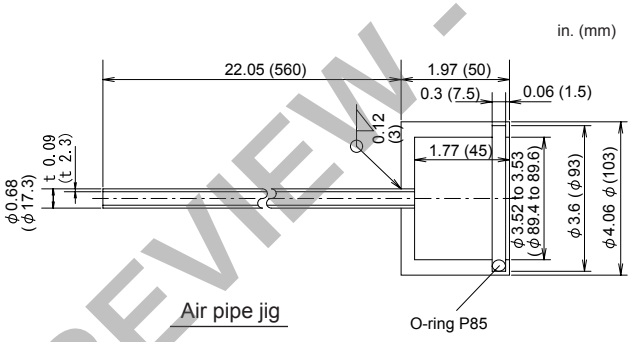
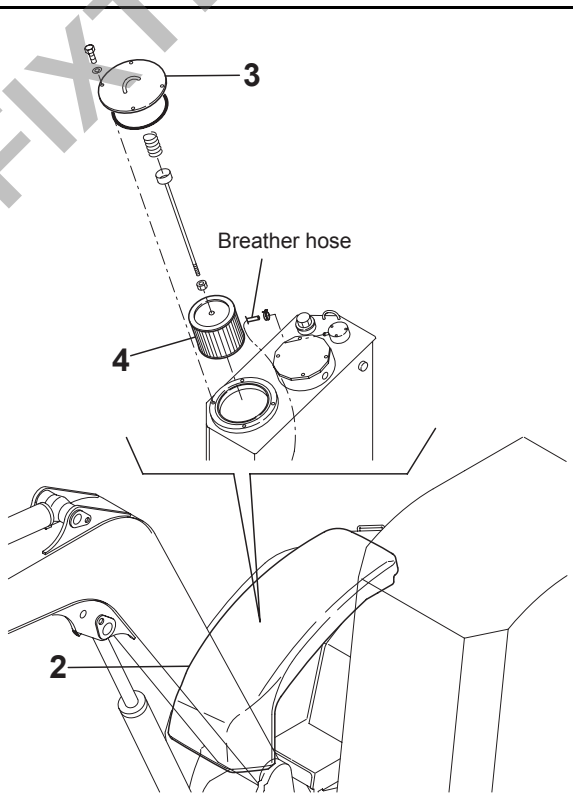
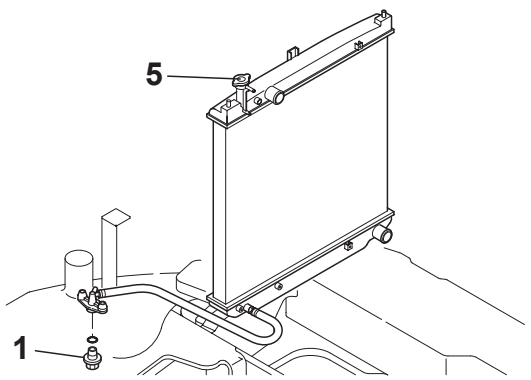
Procedure	
4. Reamer bolt fastening (1) Apply anti-seizure agent to the reamer part of the reamer bolts and Loctite # 638 on its thread. ***Notes :*** • *If grease adheres to the screw section corresponding to the reamer bolt **19** of the spindle **2**, degrease with degreaser and wash.* • *Tighten the 3 reamer bolts **19** equally, a little at a time. If you tighten 1 or 2 before the other, the hold flange **3** will tilt, and you will not be able to correctly insert the ball bearing **21** in the hold flange **3**.* (2) Tighten the reamer bolts **19** (3 bolts) to the specified torque. Specified torque : 620 to 685 ft•lbf (835 to 930 N•m) (3) Invert the travel motor. (4) Remove the fixtures (2 fixtures). (5) Invert the travel motor.	

5. Fitting the snap ring (1) Check if the spindle kit and RV gear assembly parts haven't been replaced with new ones. ***Notes :*** • *If there are no renewal parts, proceed to the next step 2. If there is even 1 renewal part, proceed to the next step 6 after carrying out "21. Shaft direction clearance adjustment of the tapered roller bearing".* • *If using by replacing the snap ring **20** only with a new part, select the same type of snap ring **20** as before disassembly or one which is similar from among the 12 types.* (2) Mount the snap ring **20** in the snap ring groove of the hold flange **3**. ***Note :*** *Match the 3 snap rings **20** with the counter mark of the hold flange **3**, and mount each in the same position as before disassembly.* *If using a new snap ring **20**, mount a snap ring **20** of the thickness selected in the previous step in the snap ring groove.*	

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7-1-7 Removal and Reinstallation of Radiator

1) Removal

Procedure	
(1) Swing the upperstructure so that drain plug **1** for cooling water is positioned halfway between the right and left crawlers. Then, lower the bucket to the ground and stop the engine.	
(2) When removing the hydraulic hoses, prevent hydraulic oil from flowing out as follows : 1. Open bonnet B **2**. 2. Remove hydraulic oil tank cover **3** and suction filter **4**. 3. Insert an air pipe jig, as shown in the figure below, into the hole for the suction filter. Alternatively, a compression vacuum, which is installed to the breather hose of the hydraulic oil tank, can be used if a stable air pressure (air from a compressor) can be ensured. 4. Run the engine for about 30 to 60 seconds and stop the engine immediately after a bubbling sound is heard from the top end of the air pipe. 	
(3) Remove drain plug **1** from the two-way cock for cooling water to drain the cooling water. Q'ty : 10.57 Qts. (10 L) Remove radiator cap **5** to drain the cooling water smoothly.	

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3) Cautions for Handling and Storing Seals

(1) O-rings are packed in the package that is suitable for storage.
(2) Do not leave the O-rings outside the package.
(3) For storing, put the O-rings in the packages and place them in a dark and cool place (in a parts box or cardboard box) under 104°F (40°C) to avoid direct sunlight.
(4) Do not put anything on the O-rings, or they may be distorted.

4) How to Fit O-rings (for inner side)

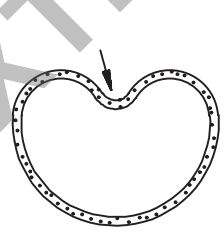
• Before fitting

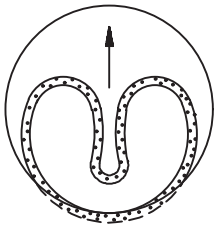
(1) There may be a clearance (within 3% of the shaft dia.) between the seal ring and the back ring.
This is normal condition.
(2) Check that there is no distortion, flaw or other abnormality on the seal ring and the back ring.

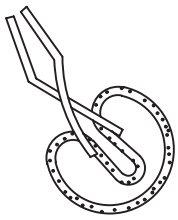


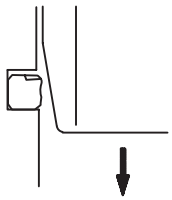
• Fitting

(1) Dry the seal groove. Push an end of the seal ring into the groove and fit the whole part while pressing the seal ring with your fingers.
Take care not to twist the seal ring.
(2) Use lithium soap group multipurpose grease.
(3) For fitting a seal ring, make it heart-shaped as shown in the figures at the right and press one end of it into the groove. Then, fit the whole seal ring while pressing it with your finger (Figs. 1 and 2).
(4) When using jigs for fitting seal rings, use the jigs with round edges to avoid damaging the seal rings. (Fig. 3)
(5) If the seal ring is distorted after fitting, correct the distortion with the jig before assembly. (Fig. 4)


Fig. 1


Fig. 2


Fig. 3


Fig. 4

5) Repair and Replacement of Parts

(1) Disassemble and reassemble at a place free from dust.
(2) Completely remove the contamination, foreign matter (sludge), etc. from the disassembled parts.
(3) Check for flaws or nicks on the seal surface of the shaft.
Repair or replace the part when necessary.
(4) Replace the shaft if it is worn.
(5) Replace all seals in reassembly.

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9. FUEL, LUBE OIL AND GREASE RECOMMENDED

9. Fuel, Lube Oil and Grease Recommended

Item	Recommended type	Capacity
Fuel oil	Diesel fuel oil US No.2 diesel fuel oil	31.7 Gals. (120 L)
Engine oil	SAE 10W30 / 15W40, API CD / CF class	10.78 Qts. (10.2 L)
Hydraulic oil	ISO VG46	In the tank : 15.05 Gals. (57 L) Other parts : 14.00 Gals. (53 L)
Swing reduction gear oil	Gear oil SAE90 (GL-4)	1.59 Qts. (1.5 L)
Travel reduction gear oil	Gear oil SAE90 (GL-4)	2.64 Qts. (2.5 L) each
Cooling water	YANMAR genuine long-life coolant (LLC) 51 % added water	Radiator : 10.57 Qts. (10 L) Subtank : 0.42 Qts. (0.4 L)
Grease	Multipurpose grease	
Antifreeze	Long-life coolant	

Part to be refilled	Oil type	Recommendations with regard to temperature ranges (°F) -4 14 32 50 68 86 (°C) (-20) (-10) (0) (10) (20) (30)	Prescribed amount of oil	Amount of oil to be changed
Engine oil pan	Engine oil	SAE 10WCD SAE 10W-30CD SAE 15W-40CD	10.78 Qts. (10.2 L)	10.78 Qts. (10.2 L)
Swing reduction gear	Gear oil	SAE 90 (GL-4)	1.59 Qts. (1.5 L)	1.59 Qts. (1.5 L)
Travel reduction gear	Gear oil	SAE 90 (GL-4)	2.64 Qts. (2.5 L) (For right and left each)	2.64 Qts. (2.5 L) (For right and left each)
Hydraulic oil system	Hydraulic oil	ISO VG46	In the tank 15.05 Gals. (57 L) Other parts 14.00 Gals. (53 L)	15.05 Gals. (57 L)
Fuel tank	Light oil	No.2-D No.3-D No.3-D (S)	31.7 Gals. (120 L)	-
Cooling system	Water	YANMAR genuine long-life coolant (LLC) added	Radiator 2.6 Gals. (10 L) Subtank 0.1 Gals. (0.4 L)	-

Mixture ratio of cooling water and antifreeze

Lowest temperature	°F (°C)	23 (-5)	14 (-10)	5 (-15)	-4 (-20)	-13 (-25)	-22 (-30)	-31 (-35)	-40 (-40)
Amount of anti-freeze	Qts. (L)	0.42 (1.6)	0.69 (2.6)	0.82 (3.1)	0.95 (3.6)	1.11 (4.2)	1.24 (4.7)	1.37 (5.2)	1.50 (5.7)
Amount of water	Qts. (L)	2.33 (8.8)	2.06 (7.8)	1.93 (7.3)	1.80 (6.8)	1.64 (6.2)	1.51 (5.7)	1.37 (5.2)	1.25 (4.7)

Note :
At the delivery, water and antifreeze are mixed at the ratio for -31 °F (-35 °C) temperature above.

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